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**INFORMATION ON FERNALD NUCLEAR MATERIAL**

**02/04/97**

**DOE-0458-97  
DOE-FEMP      SCIENTECH INC  
7  
LETTER**



**Department of Energy**

**Ohio Field Office  
Fernald Area Office**  
P. O. Box 538705  
Cincinnati, Ohio 45253-8705  
(513) 648-3155



FEB 4 1997

DOE-0458-97

**Mr. Robert D. Copp**  
Scientech, Inc  
956 Energy Drive  
Idaho Falls, ID 83401

Dear Mr. Copp:

**INFORMATION ON FERNALD NUCLEAR MATERIAL**

**Reference:** Informal Note from Robert Copp to Jack Craig, "Special Nuclear Material Accountability," dated December 20, 1996.

In response to the above referenced note, unclassified information has been prepared for you. This information is enclosed and discusses inventory differences at the Department of Energy, Fernald Environmental Management Project (DOE-FEMP). We hope that the enclosed material answers your questions.

If you need further details, please contact me at (513) 648-3101.

Sincerely,

Jack R. Craig  
Director

FEMP:Gareis

Enclosure: As Stated

cc w/enc:

D. Govans, EM-42/GTN  
G. Griffiths, DOE-FEMP  
J. Neyer, DOE-FEMP  
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## Special Nuclear Material Accountability Information for SCIENTECH, Inc.

All nuclear material at the Fernald Environmental Management Project (FEMP) is low enriched uranium (less than 20% U235 enrichment), normal uranium, or depleted uranium. The low enriched uranium is special nuclear material, and the normal and depleted uranium are source materials. Separate areas throughout the facility called material balance areas (MBA) are defined for the nuclear material storage, and each MBA has a custodian assigned to it for material control and accountability purposes.

### 1. Terms used at Fernald and how are they defined.

An accurate inventory of all nuclear materials at the FEMP is an important part of the Nuclear Materials Control and Accountability Program. Nuclear materials transactions for a period are used to calculate the book inventory, which is then compared with the ending physical inventory (performed annually) to produce an inventory difference (ID). An inventory difference is defined as a difference in the book inventory as a result of activities that include beginning inventory, ending inventory, total shipments and receipts. The inventory difference is calculated as follows and can be either a gain or loss:

Inventory Difference (ID) = BI + R - S - EI, where

BI = the beginning inventory for the period being reconciled.

R = the receipts into the area for the period being reconciled.

S = the shipments out of an area for the period being reconciled, including measured discards.

EI = the ending inventory for the period being reconciled.

### 2. What makes up "inventory differences" at Fernald?

During production days the IDs were a result of an inherent inability to accurately sample and analyze uranium bearing process residues. Heterogeneous feed materials received from other sites, especially normal ore concentrates were not amenable to representative sampling. Since process operations were terminated in 1989, ID gains have been experienced as a result of uranium recovery in the form of equipment cleanout, sump cakes, contaminated soil, and contaminated trash. These materials are added to the site inventory as they are generated, and most are subsequently transferred to the waste account.

### 3. History of Fernald's "inventory differences" for plutonium and/or uranium.

Fernald has never produced plutonium products. However, a few grams of plutonium have been received as contaminants in recycled uranium feed materials during the years of production. The IDs for uranium streams as a percentage of the total receipts of uranium for the 44-year period (Fiscal Years 1952-1995) is 0.40%. The attached tables provide additional information regarding the inventory differences.

### 4. Suspected Holdup locations.

Holdup material is still present in facilities undergoing safe shutdown activities. The facilities expected to generate cleanout materials from holdup in storage bins, pipes, equipment, trenches, and ductwork are: Plant 1, Plant 2/3, Plant 5, Plant 6, Plant 8, Plant 9, and the Pilot Plant. The estimated amount remaining is approximately 10 to 15 metric tons uranium. These materials will

be recovered over the next 2-3 years as the Safe Shutdown program is completed.

5. Discussion of history of improvement of measurement hardware capability in terms of sensitivity and uncertainty.

During the 1980's all of the analog mechanical scales were replaced with digital electronic scales which allowed for better readings and minimized transcription errors. Also, controls, standards, and maintenance are used to minimize errors in weight measurements. All scales and balances used for accountability purposes at the FEMP are maintained, calibrated according to established procedures and schedules, and tested for zero and range accuracy each day the scale is used. In addition, the analytical laboratory has kept up with the state of the art technology in updating its equipment. The analyses are performed on a statistical basis with the ability to analyze more samples if the initial sample was not within a specified error band.

6. Other information that might be of help in characterizing any "inventory differences" at Fernald.

Statistically derived control limits no longer apply at the FEMP because there is no active production. As noted above, there may be ID gains due to recovery of materials previously reported as book losses. These gains can not be predicted, but are fully documented and explained in the year end Material Balance Reports.

FERMCO  
MATERIAL BALANCE SUMMARY AT THE FEMP  
Table I - Normal Uranium - Kgs U

Fiscal Year	Beginning Inventory	Total Receipts	Total Shipments	Ending Inventory	Conversion Adjustment	Inventory Difference	% ID
1952	0	861,072	147,844	711,797		1,431	0.166
1953	711,797	3,220,945	2,993,431	931,287		8,024	0.204
1954	931,287	6,015,033	4,700,328	2,216,219		29,773	0.429
1955	2,216,219	9,124,181	9,458,009	1,828,148		54,243	0.478
1956	1,828,148	12,140,539	11,681,408	2,264,691		22,588	0.162
1957	2,264,691	13,698,922	13,245,587	2,677,997		40,029	0.251
1958	2,677,997	13,837,447	13,624,750	2,828,503		62,191	0.377
1959	2,828,503	14,739,766	13,039,824	4,479,551		48,894	0.278
1960	4,479,551	16,124,974	15,136,187	5,436,575		31,763	0.154
1961	5,436,575	13,744,428	13,802,312	5,312,383		66,308	0.346
1962	5,312,383	10,715,422	11,327,150	4,637,373		63,282	0.395
1963	4,637,373	14,201,424	12,398,839	6,427,890		12,068	0.064
1964	6,427,890	10,286,046	11,317,433	5,444,381		(47,878)	(0.286)
1965	5,444,381	6,325,246	8,059,696	3,906,088		(196,157)	(1.667)
1966	3,906,088	5,262,556	4,388,065	4,767,366		13,213	0.144
1967	4,767,366	17,537,922	3,783,666	18,492,840		28,782	0.129
1968	18,492,840	213,330	5,394,217	13,276,492		35,461	0.190
1969	13,276,492	204,392	1,054,562	12,420,926		5,396	0.040
1970	12,420,926	1,050,015	1,933,874	11,559,759		(22,692)	(0.168)
1971	11,559,759	517,975	682,595	11,378,131		17,008	0.141
1972	11,378,131	4,896,857	2,183,461	14,103,031		(11,504)	(0.071)
1973	14,103,031	34,903	3,536,195	10,604,762		(3,023)	(0.021)
1974	10,604,762	8,511,493	7,352,833	11,760,472		2,950	0.015
1975	11,760,472	8,147,548	8,119,202	11,727,766		61,052	0.307
1976	11,727,766	211,753	8,407,406	3,528,359		3,754	0.031
1976A	3,528,359	249,757	1,659,041	2,114,739		4,336	0.115
1977	2,114,739	1,785,124	3,859,451	49,219		(8,807)	(0.226)
1978	49,219	11,358	4,925	55,587		65	0.107
1979	55,587	68,788	250	124,125		0	0.000
1980	124,125	7,924	257	131,792		0	0.000
1981	131,792	879	6,879	125,792		0	0.000
1982	125,792	7,739	9,302	124,229		0	0.000
1983	124,229	7,913	60,287	71,855		0	0.000
1984	71,855	485,765	88,893	468,630		97	0.017
1985	468,630	1,450,993	1,122,930	796,057		636	0.033
1986	796,057	2,499,047	2,574,037	717,371		3,696	0.112
1987	717,371	385,234	481,105	618,089	(230)	3,641	0.330
1988	618,089	80,892	90,861	605,836		2,284	0.327
1989	605,836	164,773	227,353	541,771		1,485	0.193
1990	541,771	237,250	251,677	529,639		(2,295)	(0.295)
1991	529,639	2,098	73,934	457,844		(41)	(0.008)
1992	457,844	165,559	175,108	448,304		(9)	(0.001)
1993	448,304	189,025	189,039	448,292		(1)	(0.000)
1994	448,292	7,048	6,650	448,723		(33)	(0.007)
1995	448,723	43,784	282,300	215,272		(5,064)	(1.028)
1952-1995	0	199,475,139	198,933,152	215,272	(230)	326,946	0.164

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 MATERIAL BALANCE SUMMARY AT THE FEMP  
 Table II - Depleted Uranium - Kgs U

Fiscal Year	Beginning Inventory	Total Receipts	Total Shipments	Ending Inventory	Conversion Adjustment	Inventory Difference	% ID
1952	0	11,199	10,798	343		58	0.518
1953	343	106,355	43,058	62,964		676	0.634
1954	62,964	1,034,315	619,628	477,376		275	0.025
1955	477,376	2,996,039	2,836,802	626,847		9,766	0.281
1956	626,847	4,254,093	3,896,056	995,122		(10,238)	(0.210)
1957	995,122	39,788	526,190	509,093		(373)	(0.036)
1958	509,093	41,220	220,975	327,130		2,208	0.401
1959	327,130	97,355	63,966	361,849		(1,330)	(0.313)
1960	361,849	41,377	217,441	186,129		(344)	(0.085)
1961	186,129	11,011	171,734	25,367		39	0.020
1962	25,367	2,005	2,058	25,345		(31)	(0.113)
1963	25,345	566	1,863	24,038		10	0.039
1964	24,038	66,165	36,121	53,507		575	0.637
1965	53,507	49	6,716	46,797		43	0.080
1966	46,797	123,791	24,713	141,530		4,345	2.547
1967	141,530	839,129	379,382	604,958		(3,681)	(0.375)
1968	604,958	3,366,773	3,037,776	926,766		7,189	0.181
1969	926,766	3,613,461	3,333,210	1,199,681		7,336	0.162
1970	1,199,681	2,803,150	2,564,212	1,436,769		1,850	0.046
1971	1,436,769	2,522,185	2,826,509	1,129,512		2,933	0.074
1972	1,129,512	2,688,755	2,685,511	1,132,325		431	0.011
1973	1,132,325	4,998,412	5,290,115	851,723		(11,101)	(0.181)
1974	851,723	2,537,959	2,505,149	895,335		(10,802)	(0.319)
1975	895,335	2,096,738	1,521,452	1,467,108		3,513	0.117
1976	1,467,108	2,731,266	3,161,526	1,039,370		(2,522)	(0.060)
1976A	1,039,370	2,147,502	2,373,421	815,089		(1,638)	(0.051)
1977	815,089	17,365,671	11,937,509	6,240,444		2,807	0.015
1978	6,240,444	14,768,211	14,608,257	6,400,596		(198)	(0.001)
1979	6,400,596	9,834,936	11,413,925	4,825,357		(3,750)	(0.023)
1980	4,825,357	13,229,370	14,784,666	3,276,202		(6,141)	(0.034)
1981	3,276,202	16,109,753	16,869,159	2,522,580		(5,784)	(0.030)
1982	2,522,580	29,332,637	29,441,520	2,415,546		(1,849)	(0.006)
1983	2,415,546	25,447,013	25,370,891	2,511,810		(20,142)	(0.072)
1984	2,511,810	37,189,319	34,878,963	4,822,816		(650)	(0.002)
1985	4,822,816	32,095,317	30,713,036	6,206,084		(987)	(0.003)
1986	6,206,084	45,531,874	42,853,178	8,886,941		(2,161)	(0.004)
1987	8,886,941	65,463,256	61,267,028	13,084,486	(1,823)	506	0.001
1988	13,084,486	36,583,955	37,772,575	11,888,903		6,963	0.014
1989	11,888,903	9,208,808	10,959,010	10,147,039		(8,338)	(0.040)
1990	10,147,039	4,664,587	5,871,500	8,938,066		2,060	0.014
1991	8,938,066	952,308	2,221,120	7,671,899		(2,645)	(0.027)
1992	7,671,899	3,312,453	6,096,745	4,888,866		(1,259)	(0.011)
1993	4,888,866	426,209	478,730	4,837,804		(1,459)	(0.027)
1994	4,837,804	533,536	1,670,052	3,701,899		(611)	(0.011)
1995	3,701,899	372,697	575,803	3,500,591		(1,798)	(0.044)
1952-1995	0	401,592,568	398,140,049	3,500,591	(1,823)	(46,249)	(0.012)

FERMCO  
 MATERIAL BALANCE SUMMARY AT THE FEMP  
 Table III - Enriched Uranium - Kgs U

Fiscal Year	Beginning Inventory	Total Receipts	Total Shipments	Ending Inventory	Conversion Adjustment	Inventory Difference	% ID
1953	0	18,607.7	11,783.4	6,806.3		18.0	0.097
1954	6,806.3	1,925.0	4,165.0	4,569.9		(3.6)	(0.041)
1955	4,569.9	39,873.4	29,856.4	14,752.5		(165.6)	(0.373)
1956	14,752.5	33,219.3	33,980.7	14,034.3		(43.2)	(0.090)
1957	14,034.3	179,453.1	90,788.6	102,150.8		548.0	0.283
1958	102,150.8	579,202.0	514,399.3	163,015.5		3,938.0	0.578
1959	163,015.5	1,085,975.1	760,435.7	490,428.0		(1,873.1)	(0.150)
1960	490,428.0	995,129.3	876,330.2	602,584.3		6,642.8	0.447
1961	602,584.3	1,825,388.4	1,500,589.6	920,291.6		7,091.5	0.292
1962	920,291.6	2,670,001.4	2,123,556.5	1,473,024.9		(6,288.4)	(0.175)
1963	1,473,024.9	3,727,004.7	3,002,777.9	2,189,506.4		7,745.3	0.149
1964	2,189,506.4	6,233,848.6	5,653,246.6	2,671,486.7		98,621.7	1.171
1965	2,671,486.7	5,697,500.3	5,486,333.8	2,937,305.4		(54,652.2)	(0.653)
1966	2,937,305.4	5,916,988.7	5,578,362.8	3,261,493.6		14,437.7	0.163
1967	3,261,493.6	6,035,954.2	6,236,488.3	3,111,606.6		(50,647.1)	(0.545)
1968	3,111,606.6	5,236,829.4	5,293,521.2	3,029,706.5		25,208.3	0.302
1969	3,029,706.5	4,381,310.6	3,256,650.3	4,144,143.8		10,223.0	0.138
1970	4,144,143.8	3,104,469.4	2,118,433.3	5,136,498.5		(6,318.6)	(0.087)
1971	5,136,498.5	1,098,555.2	1,597,123.2	4,651,057.6		(13,127.1)	(0.211)
1972	4,651,057.6	1,301,486.8	2,447,372.7	3,521,104.4		(15,932.7)	(0.268)
1973	3,521,104.4	2,157,031.8	2,110,891.6	3,565,320.7		1,923.9	0.034
1974	3,565,320.7	1,816,095.8	2,379,965.4	3,011,723.1		(10,272.0)	(0.191)
1975	3,011,723.1	171,820.1	677,844.6	2,505,327.4		371.2	0.012
1976	2,505,327.4	237,398.1	347,893.1	2,397,294.2		(2,461.8)	(0.090)
1976A	2,397,294.2	124,529.4	201,431.7	2,318,474.0		1,917.9	0.076
1977	2,318,474.0	5,442,258.3	5,604,370.0	2,124,457.9		31,904.4	0.411
1978	2,124,457.9	3,810,777.4	4,077,373.5	1,859,038.6		(1,176.8)	(0.020)
1979	1,859,038.6	3,725,809.2	3,589,307.3	1,994,886.3		654.2	0.012
1980	1,994,886.3	3,546,008.6	3,658,963.2	1,887,793.5		(5,861.8)	(0.106)
1981	1,887,793.5	5,017,394.9	5,032,893.6	1,872,342.4		(47.6)	(0.001)
1982	1,872,342.4	6,458,371.9	6,256,357.4	2,074,660.1		(303.2)	(0.004)
1983	2,074,660.1	12,976,748.6	13,344,106.1	1,702,678.4		4,624.2	0.031
1984	1,702,678.4	11,661,583.3	11,660,377.9	1,698,978.8		4,905.0	0.037
1985	1,698,978.8	11,490,509.4	11,255,689.9	1,935,357.6		(1,559.3)	(0.012)
1986	1,935,357.6	9,858,635.3	9,503,209.3	2,294,435.4		(3,651.8)	(0.031)
1987	2,294,435.4	5,285,981.6	5,068,867.5	2,513,067.1		(1,517.6)	(0.020)
1988	2,513,067.1	2,787,173.0	2,831,964.4	2,480,900.1		(12,624.4)	(0.238)
1989	2,480,900.1	827,637.7	835,662.7	2,483,122.1		(10,247.0)	(0.310)
1990	2,483,122.1	1,588,878.1	1,614,932.6	2,456,212.4		855.2	0.021
1991	2,456,212.4	523,235.1	672,827.5	2,307,664.6		(1,044.6)	(0.035)
1992	2,307,664.6	571,245.0	607,438.6	2,273,316.7		(1,845.7)	(0.064)
1993	2,273,316.7	765,260.0	766,526.3	2,272,787.8		(737.4)	(0.024)
1994	2,272,787.8	538,059.3	644,950.4	2,166,559.3		(662.6)	(0.024)
1995	2,166,559.3	817,854.7	818,249.8	2,169,502.2		(3,338.0)	(0.112)
1952-1995	0	142,363,019.2	140,178,289.9	2,169,502.2		15,227.1	0.011

